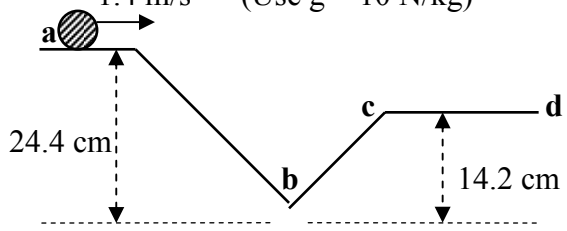
PHYSICS 12 WORK & ENERGY WORKSHEET 2

NOTE: Assume 100% efficiency for questions 1-7 only.

1. A 250 g projectile is fired directly upwards from a cannon and rises to a height of 150 m.
   a) What is its E_p at the top of its flight?
   b) With what E_k did it leave the cannon?
   c) What was its kinetic energy at the moment it reached an altitude of 100 m?

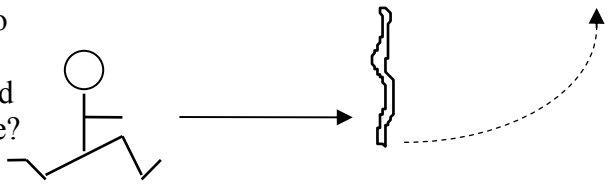
2. A projectile is fired from the ground and reaches a maximum height of 16.8 m. If its speed at the maximum height is 8.0 m/s, with what speed will it hit the ground?

3. 1.4 m/s (Use g = 10 N/kg)



   a) Section **abc** is a frictionless track. What will the ball's speed be at **c**?
   b) Section **cd** exerts a constant friction force equal to 1/8 the weight of the ball. How far will the ball travel before it comes to a stop? (Hint: use $\mathbf{F_{Net}} = \mathbf{F_f}$ to find acceleration)

4. Tarzan wishes to use a light vine to swing from the ground onto a tree branch 3.5 m high. How fast should he be going when he grabs the vine?



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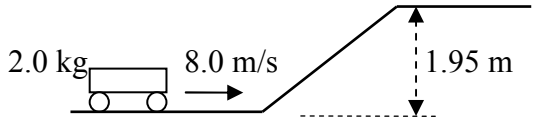


Calculate the speed of the cart in the diagram once it reaches the higher level of the frictionless track.

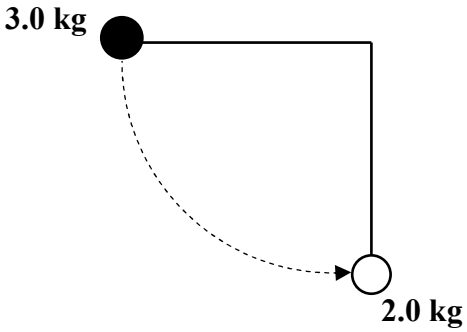
6. A 0.20 kg stone falls from a height of 50 m to a point 40 m above the ground. Neglecting wind resistance,
   a) How much E_p has it lost? b) How much E_k has it gained?

7. A mass of 10.0 kg is dropped from a height of 10 m. Neglecting wind resistance, determine its E_p, E_k and *total* energy when it is: a) 10.0 m b) 8.0 m c) 5.0 m d) 0 m from the ground.

8. A 10 kg pendulum mass is held, then released from a height of 0.35 m. At the bottom of its swing the speed of the pendulum is measured as 2.4 m/s.
   a) What is the total energy of the pendulum before it is released?
   b) How much kinetic energy does the pendulum have at the bottom of the swing?
   c) How much energy was lost to heat in this situation?
   d) How efficient was the pendulum at converting its potential energy to kinetic energy?
   e) If the pendulum was 100% efficient, how fast *would* the mass have been moving at the bottom of the swing?

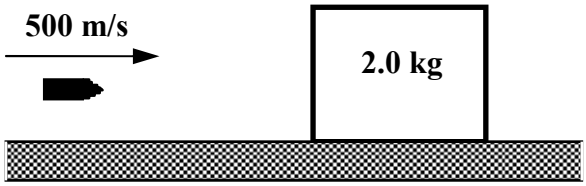
9. A 2.0 kg mass moving to the right at 2.0 m/s collides head-on with a 1.0 kg mass initially at rest. After the collision the 2.0 kg mass is moving to the right at 1.0 m/s. Calculate the loss in energy of the system to heat. (Hint: use cons. of momentum first to find speed <u>after</u> the collision)

10. Two compact masses of 2.0 and 3.0 kg each are suspended from the same point by strings each 4.0 m long. The 3.0 kg mass is pulled back until its string is horizontal, and then released. When it collides with the 2.0 kg mass, the two stick together.



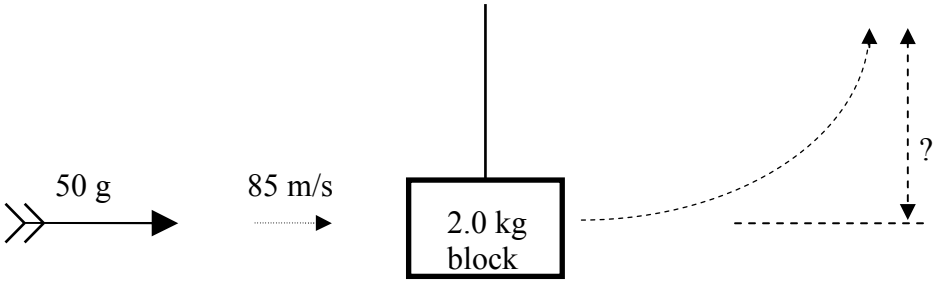
a) Calculate the vertical height to which the combined masses will rise.
b) How much kinetic energy is lost in the collision?

11. A 4.0 g bullet, moving horizontally with a speed of 500 m/s, strikes a motionless 2.0 kg wooden block sitting on a rough, horizontal surface. The bullet passes through the block in a negligible time interval, emerging with a speed of 100 m/s and causing the block to slide 0.40 m along the surface before coming to rest.



a) Determine the speed of the block just after the bullet exits.
b) Calculate the maximum kinetic energy of the block.
c) Find the average frictional force stopping the block.
d) Find the work done on the bullet by the block to slow it down.
e) Explain why your answers to (b) and (d) are not equal.

12.



Examine the diagram. If the arrow embeds in the hanging wood block, how high will the block and arrow rise?

1. a) 368 J b) 368 J c) 123 J 2. 19.8 m/s 3. a) 2.0 m/s b) 1.6 m 4. 8.3 m/s 5. 5.1 m/s 6. a) 20 J b) 20 J
7. a) 980, 0, 980 b) 784, 196, 980 c) 490, 490, 980 d) 0, 980, 980 8. a) 34 J b) 29 J c) 5 J d) 85% e) 2.6 m/s
9. 1.0 J 10. a) 1.4 m b) 47 J 11. a) 0.80 m/s b) 0.64 J c) -1.6 N d) -480 J e) collision not 100% elastic; loss of energy to heat, sound etc. 12. 0.22 m